

We claim:

1. A system for detecting symptoms of hypoglycemia in a diabetic individual, comprising:
 - 5 a temperature sensing system for producing a temperature signal representative of a skin temperature of the diabetic individual;
 - a conductance sensing system for producing a conductance signal representative of a level of perspiration of the diabetic individual;
 - a trending system responsive to the temperature signal for producing a slope
10 estimate representative of a rate of change of the skin temperature over a predetermined interval;
 - a threshold system responsive to the conductance signal and to the temperature signal for producing a slope threshold representative of a hypoglycemic decline in skin temperature observed over the
15 predetermined interval; and
 - an alarm system responsive to the slope estimate and to the slope threshold for producing an indication of the presence of hypoglycemic symptoms.
- 20 2. A system as defined in claim 1, wherein the alarm system produces the indication when the slope estimate falls below the slope threshold.
3. A system as defined in claim 2, wherein the alarm means does not
25 produce the indication when the slope estimate falls below an artifact rejection threshold, the artifact rejection threshold representing a rate of change of the skin temperature not indicative of hypoglycemic symptoms.

4. A system as defined in claim 3, wherein the artifact rejection threshold is less than the slope threshold.

5 5. A system as defined in claim 1, wherein the trending system produces the slope estimate through a linear regression analysis.

6. A system as defined in claim 1, wherein the threshold system decreases the slope threshold when the level of perspiration increases, and wherein
10 the threshold system increases the slope threshold when the level of perspiration decreases.

7. A system as defined in claim 1, wherein the threshold system decreases the slope threshold when the skin temperature increases, and wherein the
15 threshold means increases the slope threshold when the skin temperature decreases.

8. A system as defined in claim 1 wherein the alarm system produces an indication of the presence of hypoglycemic symptoms when the level of perspiration
20 rises above a predetermined threshold representative of a hypoglycemic level of perspiration.

9. A system as defined in claim 8 wherein the alarm system produces an indication of a depleted battery when a battery potential falls below a predetermined
25 battery alarm threshold.

10. A system as defined in claim 9 further comprising a strap formed of hypoallergenic and conformable elastomer and defining a stretchable recess, a hook fabric strip, and a loop fabric strip.

5 11. A system as defined in claim 9 further comprising an elastomeric cup defining a stretchable recess and a spring clip member.

12. A system for detecting symptoms of hypoglycemia in a diabetic individual, comprising:

10 a temperature sensing system for producing a temperature signal representative of a skin temperature of the diabetic individual;
a conductance sensing system for producing a conductance signal representative of a level of perspiration of the diabetic individual;
a signal estimation system responsive to the temperature signal and to the
15 conductance signal for producing a basal conductance reference representative of a basal level of perspiration;
a threshold system responsive to the basal conductance reference and to the skin temperature signal for producing a conductance threshold representative of a hypoglycemic level of perspiration; and
20 an alarm system responsive to the conductance signal and to the conductance threshold for producing an indication of the presence of hypoglycemic symptoms.

13. A system as defined in claim 12, wherein the alarm system produces
25 the indication when the conductance signal rises above the conductance threshold.

14. A system as defined in claim 13, wherein the alarm system produces the indication when the conductance signal rises above the conductance threshold for a predetermined length of time.

5 15. A system as defined in claim 12, wherein the signal estimation system produces the basal conductance reference by obtaining the mean of the conductance signal over a predetermined averaging interval.

10 16. A system as defined in claim 15, wherein the signal estimation system produces the basal conductance reference after a rate of change of the skin temperature signal falls below a predetermined slope threshold.

15 17. A system as defined in claim 12, wherein the threshold system increases the conductance threshold when the skin temperature increases, and wherein the threshold system decreases the conductance threshold when the skin temperature decreases.

20 18. A system as defined in claim 12 wherein the alarm system produces an indication of the presence of hypoglycemic symptoms when the skin temperature falls below a predetermined temperature threshold representative of a hypoglycemic skin temperature.

25 19. A system for detecting symptoms of hypoglycemia in a diabetic individual, comprising:
a temperature sensing system for producing a temperature signal
representative of a skin temperature of the diabetic individual;

- a conductance sensing system for producing a conductance signal
representative of a level of perspiration of the diabetic individual;
 - a trending system responsive to the temperature signal for producing a slope
estimate representative of a rate of change of the skin temperature
5 over a predetermined interval;
 - a temperature threshold system responsive to the conductance signal and to
the temperature signal for producing a slope threshold representative
of a hypoglycemic decline in skin temperature observed over the
predetermined interval;
 - 10 a temperature alarm system responsive to the slope estimate and to the slope
threshold for producing an indication of the presence of hypoglycemic
symptoms;
 - a signal estimation system responsive to the temperature signal and to the
conductance signal for producing a basal conductance reference
15 representative of a basal level of perspiration;
 - a conductance threshold system responsive to the basal conductance
reference and to the temperature signal for producing a conductance
threshold representative of a hypoglycemic level of perspiration;
 - a conductance alarm system responsive to the conductance signal and to the
20 conductance threshold for producing an indication of the presence of
hypoglycemic symptoms; and
 - a selector system for selecting an operating mode from a plurality of operating
modes.
- 25 20. A system as defined in claim 19, wherein one of the operating modes
disables the conductance alarm means.

21. A system as defined in claim 19, wherein one of the operating modes disables the temperature alarm means.

5 22. A system as defined in claim 19, wherein the one of the operating modes prevents the temperature threshold means from responding to the conductance signal.

10 23. A system as defined in claim 19, wherein the one of the operating modes prevents the temperature threshold means from responding to the temperature signal.

15 24. A system as defined in claim 19, wherein one of the operating modes prevents the conductance threshold means from responding to the temperature signal.

25. A method of detecting symptoms of hypoglycemia in a diabetic individual, comprising:

20 producing a temperature signal representative of a skin temperature of the diabetic individual;

 producing a conductance signal representative of a level of perspiration of the diabetic individual;

 producing a slope estimate representative of a rate of change of the skin temperature over a predetermined interval in response to the

25 temperature signal;

 producing a slope threshold representative of a hypoglycemic decline in skin

temperature observed over the predetermined interval in response to the conductance signal and the temperature signal; and producing an indication of the presence of hypoglycemic symptoms in response to the slope estimate and the slope threshold.

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26. A method of detecting symptoms of hypoglycemia in a diabetic individual, comprising:

producing a temperature signal representative of a skin temperature of the diabetic individual;

10 producing a conductance signal representative of a level of perspiration of the diabetic individual;

producing a basal conductance reference representative of a basal level of perspiration in response to the temperature signal and the conductance signal;

15 producing a conductance threshold representative of a hypoglycemic level of perspiration in response to the basal conductance reference and the skin temperature signal; and

producing an indication of the presence of hypoglycemic symptoms in response to the conductance signal and the conductance threshold.

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27. A method of detecting symptoms of hypoglycemia in a diabetic individual, comprising:

producing a temperature signal representative of a skin temperature of the diabetic individual;

25 producing a conductance signal representative of a level of perspiration of the diabetic individual;

- producing a slope estimate representative of a rate of change of the skin temperature over a predetermined interval in response to the temperature signal;
- 5 producing a slope threshold representative of a hypoglycemic decline in skin temperature observed over the predetermined interval in response to the conductance signal and the temperature signal;
- producing an indication of the presence of hypoglycemic symptoms in response to the slope estimate and the slope threshold;
- 10 producing a basal conductance reference representative of a basal level of perspiration in response to the temperature signal and the conductance signal;
- producing a conductance threshold representative of a hypoglycemic level of perspiration in response to the basal conductance reference and the temperature signal;
- 15 producing an indication of the presence of hypoglycemic symptoms in response to the conductance signal and the conductance threshold;
- and
- selecting an operating mode from a plurality of operating modes.